

Coal Mines

Methane is emitted from active and abandoned underground and surface mines, and as a result of post-mining activities, including coal processing, storage, and transportation. To facilitate coal mine methane (CMM) project development, GMI is building international alliances to advance methane recovery and use at coal mines throughout the world.

Underground mines are the single largest source of CMM emissions in many coal-producing countries. For years, methane in coal mines was viewed as a nuisance and a

safety hazard that had little intrinsic value. Current CMM recovery and use projects have shown the opposite is true: CMM is a clean energy source and a commodity that, when captured, can provide many benefits to the mine in terms of increased revenue, improved worker safety, and greater mine productivity.

The United States is a leader in CMM recovery and continues to work with international partners through GMI to share information, expertise, and technology to promote CMM project development.

Continuing Support for CMM Recovery and Utilization in China

In 2011, EPA continued to support CMM recovery and utilization project feasibility studies at Chinese coal mines. The studies assess the technical and economic viability of implementing methane recovery and utilization projects, with detailed findings and project implementation recommendations compiled in comprehensive final reports.

With EPA funding, the Virginia Center for Coal and Energy Research (VCCER), which is affiliated with Virginia Polytechnic Institute and State University (Virginia Tech), developed a regional handbook for coalbed methane (CBM) degasification in the Southern Shanxi province of China. VCCER and its collaborative research partners conducted a detailed CBM reserve analysis on a gas-bearing coal property in China's Qinshui Coal Basin, considered to be representative of the region.

In November 2011, EPA published a report entitled *China's Energy Markets: Anhui, Chongqing, Henan, and Guizhou Provinces*. This document compiles the results of energy market analysis performed during the course of several comprehensive CMM recovery and utilization feasibility studies conducted in China. In 2011, EPA also completed

its feasibility study for CMM drainage and utilization at the Tai Xi Group Mines in Inner Mongolia, China.



Expanding mine gas storage silo in Southern Shanxi, China

Capacity-Building Meetings in India

A collaborative effort between EPA and key Indian organizations to bring India's coal methane resources to market in an environmentally beneficial manner has produced a first for India: prospective operators are being offered active coal mining blocks to develop projects to extract and utilize CMM. In early 2011, India's Central Mine Planning and Design Institute (CMPDI) issued a notice inviting tenders for five CMM blocks held by Coal India Limited (CIL).

As part of this activity, EPA met with Indian organizations focused on coal mining and methane emission reductions. During the trip, EPA toured new laboratory facilities and methane data collection field sites on the coal blocks that have been designated by the Indian government for potential CMM development.

In October 2011, EPA co-hosted the first Indo-U.S. workshop on CMM with the Central Institute of Mining and Fuel Research (CIMFR) in Dhanbad. The goal of the four-day workshop was to share information on coal seam gas and drainage and utilization technologies with local

mining officials. Presentation topics included financial feasibility of CBM/CMM projects, mine degasification systems, directional drilling, well logging, and sustainability. The workshop also included a site visit to the Parbatpur CBM development project.



Drilling cores in the Damodar Valley, India

Disseminating Best Practices and Assessing Opportunities in Kazakhstan

In 2011, the United States continued to support dissemination of a new document that GMI was integral in developing—*Best Practice Guidance for Effective Methane Drainage and Use in Coal Mines*—published by the United Nations Economic Commission for Europe (UNECE) in 2010. This publication directly contributes to improving mine safety standards at active underground coal mines by supporting safer mining practices to reduce fatalities, injuries, and property losses.

In May 2011, EPA supported a UNECE Best Practices Workshop in Karaganda. The workshop featured international experts presenting on best practices for pre-mine drainage, post-mining drainage drilling methods, methane utilization and abatement, and the current status of gas drainage and utilization at Arcelor Mittal Lenina Mine in Temirtau.

EPA conducted a mission to Kazakhstan to learn more about the current status of the country's coal industry and discuss areas for potential CMM project opportunities. Subsequently, EPA published *Deep Gassy Coal Mines of Karaganda Coal Basin*, which features detailed information on the Karaganda Coal Basin. The report highlights current CMM capture and utilization opportunities for four Arcelor Mittal Temirtau underground coal mines—Kazakhstanskaya, Lenina, Abaiskaya, and Tentekskaya—and seeks to identify potential opportunities for future site-specific assessments.

Supporting a Cogeneration Project in Poland

In 2011, an EPA-funded feasibility study found that methane from the abandoned Zory Coal Mine in Poland could be economically extracted and converted to liquefied natural gas (LNG). The report estimated that CMM captured from the abandoned Zory Coal Mine could help avoid 490,000 billion cubic meters (m³) in methane emissions annually. Based on the study's finding that the project could be even more economical, a 2-megawatt (MW) combined heat and power (CHP) plant generation unit has been in operation at the mine since 2010. The engine is fueled with gas from the mine, power is sold to a power supply corporation power trader, and the thermal energy is sold to a heat supplier for a small housing estate. The system produces about 46,500 kilowatt-hours of energy per day, which is enough to power more than 11,000 households, and the thermal energy serves almost 1,800 apartments.



CHP unit at abandoned Zory Coal Mine in Poland

Continuing Technical Discussions in Ukraine

In September 2011, EPA hosted a technical workshop in conjunction with a UNECE Best Practices Workshop in Donetsk. The two-day GMI event was attended by nearly 100 participants and brought together key CMM recovery and utilization experts to share information about the state of Ukraine's coal industry, best practices for de-gasification in advance of mining, maximizing methane

capture and optimizing gas utilization, and mitigating ventilation air methane (VAM) emissions. The workshop focused on mine safety, covering topics such as current programs for training new coal mine inspectors, explosion prevention, post-mining drainage, and advanced drilling technology in overpressured formations.

Additional Coal Workshops, Scoping Missions, and Tools

EPA participated in CMM workshops in Colombia, Russia, and Turkey, and conducted a scoping mission to Vietnam to discuss CMM/CBM project development at four coal mines in Mao Khe, Quang Hanh, Duong Huy, and Khe Cham. To aid CMM project developers, EPA updated an existing CMM technology database that provides basic descriptions of key CMM recovery and utilization technologies, including each technology's current status and commercial availability.

EPA also published a white paper discussing CMM projects that involve flaring-only of drained gas. Based

on information about more than 300 projects in the GMI CMM Project Database, EPA identified 10 flaring-only projects and an additional 13 energy recovery projects that flare nonrecoverable gas. The paper compares the GHG emission benefits of flaring to both energy recovery and venting to the atmosphere. Based on the findings, the GMI Coal Mines Subcommittee adopted the position that flaring should only be considered for mines with low-concentration drained CMM, where installing CMM end-use projects might be technically or economically infeasible or impractical.